ASTR–1200–002: Stars and Galaxies CU Boulder Syllabus (Fall 2025)

Class Times & Location: Mon./Wed./Fri., 11:15 am to 12:05 pm, Duane Physics G130

Instructor: Prof. Steven R. Cranmer (steven.cranmer@colorado.edu)
Office hours: Duane D111: TBD days/times, or by appointment

Teaching Assistant: TBD (email)
Office hours: TBD days/times, and TBD time in Astronomy Help Room

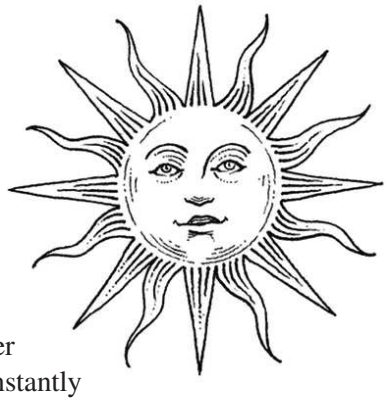
OVERVIEW

In this course, non-science majors will learn about the birth and death of stars (including our own Sun), the nature of black holes and galaxies, and the structure and evolution of the entire universe. We will discuss what astronomers know today about each of these things, how we know it, and what we still don't yet know.

WHO SHOULD TAKE THIS CLASS?

There are no formal prerequisites. ASTR 1200 is designed as a stand-alone, single-semester course, and it does not count as part of any multi-course sequence. If you have already taken ASTR 1020 or 1040, you cannot receive credit for this class. ASTR 1200 does not count toward the Astronomy major. If you are a physical sciences or engineering major, you are strongly encouraged to take the calculus-based ASTR 1030/1040 sequence instead.

COURSE GOALS



Our hope is that a graduate of this course will:

- Develop a sense of awe and appreciation about the universe.
- Understand how science allows us to confidently answer many questions that lie far outside the realm of what we experience in everyday life.
- Learn how we "stand on the shoulders of giants" by building on earlier discoveries. Science isn't a static set of rules and equations, but is constantly changing in response to new observations and interpretations.
- Develop some experience using skills such as critical thinking, problem solving, and quantitative reasoning (yes, there will be math) that are very useful for life beyond this course.
- Be inspired to share what you learn with other people (friends, family, random strangers on the bus).

YOUR INSTRUCTIONAL TEAM

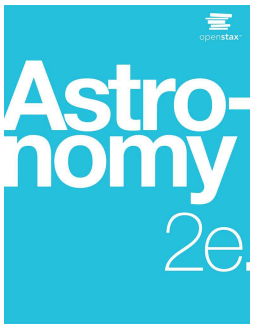
Together, the Instructor and the Teaching Assistant (TA) make up your instructional team for ASTR 1200. Our goal is to help you learn about the universe and how we use science (and some math) to understand it. We are available to (i) help discuss material from class, (ii) help with your homework, (iii) review topics while studying for exams, (iv) talk about whatever scientific or academic topics pique your curiosity, or (v) help with your personal journey through college. We each will have weekly office hours where we commit to being available to you for these activities. Also, the Astronomy Help Room (AHR) is staffed by TAs and Learning Assistants (LAs) from this and other astronomy classes. You can visit the Help Room any time you need help with any class, whether or not one of us is scheduled to be there at that time. It is open Tuesdays, Wednesdays, and Thursdays, 2:00-6:00 pm, in Duane D142.

COURSE WEB PAGES

We will use Canvas to organize nearly all of this course's material. If you're enrolled, you should have a customized link for this course's number and section. On Canvas you'll find all of the assignments, an up-to-date schedule, lecture slides, exam review materials, and more. You can subscribe to notifications to be reminded of due-dates, too.

Also, your instructor will be posting some basic course material—like this syllabus and a day-by-day schedule—on his own web page: https://stevencranmer.bitbucket.io/ASTR_1200_2025/

REQUIRED MATERIALS



Textbook: *OpenStax Astronomy,* 2nd edition, by Franknoi, Morrison, and Wolff. This is a completely free (i.e., open-access) textbook available online. You can read it in a browser, download a PDF, or buy a print copy. We will assign regular readings from this book, but sometimes we'll supplement it with other readings (to be distributed on Canvas) or YouTube videos to watch.

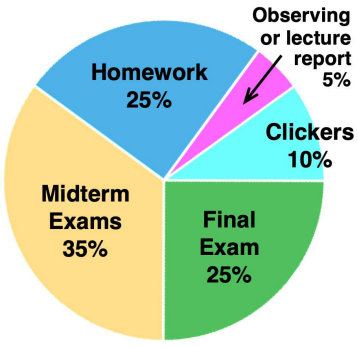
Clickers: We will use the iClicker Cloud polling system in each class session. First, you need to sign up for an iClicker student account. Then, you can **either** purchase a wireless iClicker "remote" device at the CU Book Store, **or** you can download the free iClicker Student App for your mobile phone. However, due to the mediocre quality of WiFi in many CU classrooms, the phone-app polling option is not always guaranteed to work. You won't receive credit if your polling responses are not received, so you are encouraged to have an iClicker physical remote. (You may be able to check out a remote from the Norlin Library circulation desk for the semester, but these are available on a first-come, first-served basis.)

Several times during each class, we will ask questions to get you to think carefully about some of the concepts we have covered. Often, this will involve discussion with your neighbors, but each student needs to answer on their own. Why are clickers important?

- They improve your grade! When you discuss and debate with others, your knowledge improves.
- They give *YOU* immediate feedback about what you do & do not understand.
- They tell your *US* what the class doesn't understand, so we can spend more time making things clear.

Clicker questions are graded (see below), and many classes will start with one or two questions from the assigned reading. Students generally report that these are easy if they've done the reading, but hard if they haven't. *Long story short:* it's always a good idea to do the reading before class.

YOUR GRADE



25%	Written homework assignments (lowest score dropped)
10%	Participation/Clickers (worst 5 days dropped)
5%	Attending an SBO Observing Session or Public Lecture
35%	Midterm Exams (three total, best 2 out of 3 counted)
25%	Comprehensive Final Exam

More information about each part of your grade is given below.

HOMEWORK (25%)

There will be approximately 6 or 7 written homework assignments (problem sets) over the course of the semester. Details and due-dates will be posted on Canvas, and we will try to announce them in class as frequently as possible. These assignments will be more quantitative and mathematical than many other parts of the course. You are encouraged to work with classmates, attend help sessions, and come to office hours as needed. Of course, all work submitted must be your own; please read the statements about the Honor Code below. **Your lowest homework assignment grade will be dropped.**

Homeworks are usually due electronically on Canvas by 11:59 pm on the scheduled due date. Solutions will be posted on Canvas about one week after the due date. Homework turned between the due date and the posting of the solutions will receive up to 50% credit. Once the solutions are posted, late homework cannot be accepted.

PARTICIPATION / CLICKERS (10%)

See above for other information about clickers. **Your worst 5 days of clicker scores will be dropped.** This should cover you if you are sick, have a family emergency, or need to miss class for any other reason. This can also cover technical problems with your clicker, but please let us know as soon as possible if problems are occurring. Most questions will be scored as follows:

0 points	No answer
0.6 points	Wrong answer
1 point	Correct answer

However, not all clicker questions will be graded right/wrong. We'll have some "opinion" questions with 0 points for no answer and 1 point for any answer, and we'll do our best to label them clearly.

ATTENDING AN OBSERVING SESSION OR PUBLIC LECTURE (5%)

At some point in the semester, you must choose one of two options:

- You can attend an **observing session** at the Sommers Bausch Observatory (SBO) on campus. Observe three (or more) different types of objects in the sky, sketch and/or photograph them, and write a brief report. SBO dates are "weather-permitting" and will be announced during class and posted on Canvas. Details about the reports will also be posted online.

OR

- You can attend a **public science lecture** and write a 1–2 page essay on the subjects covered and your own reaction to the presentation. Many of these public talks will be at Fiske Planetarium. If you're feeling adventurous, you can also attend an APS Department Colloquium (most Mondays at 3:30 pm in JILA Auditorium), but those can sometimes be more of a challenge to follow. Times and dates of public lectures will be announced in class as we hear about them. If you hear of other ones that you think would fit this assignment, please let us know and we will announce them as well. Details will also be posted online.

MIDTERM EXAMS (35%)

There will be three in-class midterm exams during the semester (dates: Sep. 19, Oct. 15, Nov. 7). Your best two out of three exams will count for 35% of your final grade. Some students may have to miss an exam during the semester, and we accommodate this by dropping the lowest exam score. For this reason, **there are NO makeup exams for any reason** including excused absences. (If you know ahead of time that

you may miss more than one exam, for a legitimate reason, contact us as soon as possible.) Each midterm will focus primarily on material covered during the preceding 4–5 weeks of class, but they may also require understanding of material covered during the semester so far. We'll have (at least) a half-class review session prior to each exam, and you'll have a chance before *that* to submit a list of topics or questions that you're most concerned about.

FINAL EXAM (25%)

A comprehensive final exam will be held at the university-assigned time & place. The final exam score cannot be dropped. Please don't make travel arrangements that conflict with the final exam, as there can be no late or make-up exams given. You will be allowed to bring in one sheet of handwritten notes ($8.5'' \times 11''$, both sides) for the final exam. Any material from the homeworks, lectures, or assigned readings is potential exam material.

QUESTIONS & CONCERNS

We're here to help! Please don't hesitate to get in touch with your instructor or the TA if you have questions about any aspect of the class, or if you start running into difficulties following the material or keeping up with assignments. There are many resources, including office hours, the Astronomy Help Room, and tutors available for hire. Please let us know if you need help on any aspect of the course.

How much math will there be? Some familiarity with basic algebra, geometry, and scientific notation will be helpful. We'll start by reviewing these concepts in class, and your first homework will be a "practice quiz" on Canvas (graded for completion only) to let you know the type of math that the rest of the course will use. We will also provide links to other math review sites/videos.

Is there a curve? Kind of? We start with a standard scheme for converting numerical scores to letter grades:

A: 93–100%, A–: 90–93, B+: 87–90, B: 83–87, B–: 80–83, C+: 77–80,

C: 73–77, C–: 70–73, D+: 67–70, D: 63–67, D–: 60–63, F: below 60%.

Then, at the end of the semester, we will add some constant number of points to everyone's scores (never subtract!) to take account of how challenging the course has been. At some point mid-semester, we will make available an assessment of how that process is likely to go, and we can provide approximate letter-grade progress-reports to students who want them.

CHECKLIST FOR SUCCESS IN THIS CLASS

- ☐ Attend class regularly. Sit up front and ask questions. (There are no 'dumb' questions!)
- ☐ Read your textbook.
- ☐ Put away your phone and laptop.
- ☐ Turn in *every* assignment. Partial credit is a lot better than no credit.
- ☐ Don't settle for being confused. If you don't understand something, I guarantee there will be at least 10 other students in class who also don't. You help them by asking a question.

You will receive the grade you work for.

PRELIMINARY CLASS SCHEDULE . . . . . ASTR–1200–002: Stars and Galaxies (Fall 2025)

The chapter numbers listed here are for readings in *OpenStax Astronomy* (2nd ed.) that ought to be done prior to each class. However, the exact schedule is likely to change throughout the semester. The most up-to-date schedule for readings—as well as homework & project due-dates—will be on Canvas. Each day's lecture notes will also contain the correct information.

	Monday	*Wednesday*	*Friday*
Week 1 (Aug. 18–22)			First day of class: Introduction & overview
Week 2 (Aug. 25–29)	Universe tour & some math **Ch. 1**	What is astronomy? **Ch. 2.1, 4.1–4.2**	What is astronomy? **Ch. 2.2–2.4**
Week 3 (Sep. 1–5)	Labor Day Holiday, no classes	What is astronomy? **Ch. 3.1–3.2**	**Fiske Planetarium**
Week 4 (Sep. 8–12)	Motion & Energy **Ch. 3.3–3.6**	Light & Atoms **Ch. 5.1–5.2**	Light & Atoms **Ch. 5.3–5.4**
Week 5 (Sep. 15–19)	Light & Atoms **Ch. 5.5–5.6** / Telescopes **Ch. 6**	Telescopes **Ch. 6** / *Exam Prep*	*Midterm Exam 1*
Week 6 (Sep. 22–26)	The Sun **Ch. 15.1, 16.1**	The Sun **Ch. 16.2–16.4**	The Sun **Ch. 15.2–15.4**
Week 7 (Sep. 29–Oct. 3)	The Stars **Ch. 17**	The Stars **Ch. 18**	The Stars **Ch. 19**
Week 8 (Oct. 6–10)	How Stars are Born **Ch. 20**	How Stars are Born **Ch. 21**	How Stars Evolve **Ch. 22.1–22.3**
Week 9 (Oct. 13–17)	How Stars Evolve **Ch. 22.4–22.5** / *Exam Prep*	*Midterm Exam 2*	How Stars Die **Ch. 23**
Week 10 (Oct. 20–24)	Spacetime & Black Holes **TBD (video?)**	Spacetime & Black Holes **Ch. 24.1–24.4**	Spacetime & Black Holes **Ch. 24.5–24.7**
Week 11 (Oct. 27–31)	Our Galaxy **Ch. 25.1–25.3**	Our Galaxy **Ch. 25.4–25.6**	Other Galaxies **Ch. 26.1–26.4**
Week 12 (Nov. 3–7)	Galaxy Evolution **Ch. 28.1–28.3**	The Big Bang **Ch. 26.5** / *Exam Prep*	*Midterm Exam 3*
Week 13 (Nov. 10–14)	The Big Bang **Ch. 29.1**	The Big Bang **Ch. 29.2**	**Fiske Planetarium**
Week 14 (Nov. 17–21)	The Big Bang **Ch. 29.3**	The Big Bang **Ch. 29.4**	Fate of the Universe **Ch. 28.4, 29.5**
Nov. 24–28: Fall/Thanksgiving Break, no classes			
Week 15 (Dec. 1–5)	Fate of the Universe **TBD (video?)**	Life in the Universe **Ch. 30**	Life in Universe **Ch. 30** / *Exam Prep*
Dec. 6–7: End of Term Reading Days . . . . Dec. 8–12: Finals Week (our final's date/time is TBD)			

CLASS POLICIES

You are all mature and responsible adults, and we'll do our best to treat you with respect. On your part, we hope you will do the same for your peers and instructors. For example:

- Please show up to class on time, and be ready to learn when class starts.
- Please don't leave class early, and don't start packing up before class is dismissed. If you know you'll need to leave early, please sit near the back of the room and leave as quietly as possible.
- **Laptops and tablets** can be used in class *ONLY* for note-taking, but it is discouraged. If you use a laptop, please do your best to sit so there's nobody directly behind you in the "distraction zone."
- **Phones** can only be used in class for the iClicker Student App.
- **Email courtesies:** CU requires you to regularly read email sent to your CU-provided address. When you send mail, please (1) make good use of the "Subject" line to alert us to your problem/question and the level of urgency, (2) be professional and respectful, and (3) don't worry if it takes 1 to 2 business days to see a response.

We try to provide a positive and supportive learning environment for everyone, and it's always helpful for us to hear what works best for you.

ACCEPTABLE USE OF A.I. TOOLS IN THIS CLASS

Generative artificial intelligence (AI) tools have become widely available, and they keep getting more powerful. You are encouraged to learn how to use these tools in ways that advance your learning, and we'll try to have some assignments that make good use of them. However:

- Remember that 60% of your grade in this class comes from in-class exams (with no external resources allowed) that are designed for you to demonstrate your conceptual understanding of the material. Homeworks are essentially practice work for the exams, so using AI on the homework would make you **way less prepared for the exams** than you would be if you did the work yourself.
- When an AI gives you an answer, it sounds just as convincing whether it's right or wrong. Humans aren't used to communicating with beings who can generate misinformation so fluently! You need to be aware of this, and also note that once you *USE* what the AI gives you, **its mistakes become your mistakes.** To say it another way: it is your responsibility to assure the accuracy of any work that you submit, AI or no AI.

Thus, for homework assignments that don't otherwise mention AI, we are strongly discouraging its use. For other activities like essay-writing, you may use AI tools for reviewing your work (for example, grammar checks), but *not* for actually writing text from scratch. If you use an AI tool on an assignment for this class, you must disclose that in your submission, discuss how you used it, and provide your prompts.

ACADEMIC INTEGRITY

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Honor is about integrity, ethical conduct, and pride in academic achievement and individual responsibility. Cultivating honor lays the foundation for lifelong integrity, developing in each of us the courage and insight to make difficult choices and accept responsibility for actions and their consequences, even at personal cost. The primary goal of this class is for you to learn, and cheating undermines that

primary goal. If you find yourself under circumstances or pressures that cause you to consider cheating, *please* come talk to your instructor or TA before doing so.

To be specific, violations of the Honor Code may include, but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. Understanding the course's syllabus is a vital part in adhering to the Honor Code.

All incidents of academic misconduct will be reported to the Student Conduct & Conflict Resolution office (StudentConduct@colorado.edu). Students found responsible for violating the Honor Code will be assigned resolution outcomes from Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Visit the Honor Code site for more information on the academic integrity policy.

What constitutes plagiarism / cheating?

While we encourage you to discuss the assignments and topics with your fellow students, the answers you submit must be your own independent work. If you do collaborate with other students, a good time to split off from the group is when you start to write up your answers. Use the motto **"work together, write separately"** to guide your actions. Every semester, we receive a number of homeworks with nearly-identical answers. When those are found, both students will receive zero credit for the entire assignment and may be reported to the Honor Code Office. Don't be that person!

In written work (essays), it is expected that you utilize outside sources in your research. Quoting sources is acceptable with proper attribution, however copy/pasting text from another source as your own is plagiarism and constitutes serious academic misconduct.

CLASSROOM BEHAVIOR

Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. For more information, see the classroom behavior policy, the Student Code of Conduct, and the Office of Institutional Equity and Compliance.

ACCOMMODATION FOR DISABILITIES & MEDICAL CONDITIONS

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition or injury, see the guidelines for Temporary Medical Conditions on the Disability Services website.

PREFERRED STUDENT NAMES AND PRONOUNS

CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

MISCONDUCT, DISCRIMINATION, HARASSMENT, AND/OR RETALIATION

CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits protected-class discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner abuse (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who believe they have been subjected to misconduct can contact OIEC at 303-492-2127 or email cureport@colorado.edu. Information about university policies, reporting options, and other support resources can be found on the OIEC website.

Please know that faculty and instructors have a responsibility to inform OIEC when they are made aware of incidents related to these policies regardless of when or where something occurred. This is to ensure that individuals impacted receive outreach from OIEC about resolution options and support resources. To learn more about reporting and support resources for a variety of concerns, visit Don't Ignore It.

RELIGIOUS OBSERVANCES

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. For full details, see the campus policy regarding religious observances.

MENTAL HEALTH AND WELLNESS

The University of Colorado Boulder is committed to the well-being of all students. If you are struggling with personal stressors, mental health or substance use concerns that are impacting academic or daily life, please contact Counseling and Psychiatric Services (CAPS) located in C4C or call 303-492-2277. Free and unlimited telehealth is also available through Academic Live Care. The Academic Live Care site also provides information about additional wellness services on campus that are available to students.

READING FOR FIRST DAY OF CLASS

"Disorientation"
a Twitter poem from 2018, by Dr. Katherine Mack

1. I want to make you dizzy.

   I want to make you look up into the sky and comprehend, maybe for the first time, the darkness that lies beyond the evanescent wisp of the atmosphere, the endless depths of the cosmos, a desolation by degrees.

2. I want the Earth to turn beneath you and knock your balance off, carry you eastward at a thousand miles an hour, into the light, and the dark, and the light again. I want you to watch the Earth rising you up to meet the rays of the morning Sun.

3. I want the sky to stop you dead in your tracks on your walk home tonight, because you happened to glance up and among all the shining pinpricks you recognized one as of the light of an alien world.

4. I want you to taste the iron in your blood and see its likeness in the rust-red sands on the long dry dunes of Mars, born of the same nebular dust that coalesced random flotsam of stellar debris into rocks, oceans, your own beating heart.

5. I want to reach into your consciousness and cast it outward, beyond the light of other suns, to expand it like the universe, not encroaching on some envelope of emptiness, but growing larger, unfolding inside itself.

6. I want you to see your world from four billion miles away, a tiny glint of blue in the sharp white light of an ordinary star in the darkness. I want you to try to make out the boundaries of your nation from that vantage point, and fail.

7. I want you to feel it, in your bones, in your breath, when two black holes colliding a billion light years away sends a tremor through spacetime that makes every cell in your body stretch, and strain.

8. I want to make you nurse nostalgia for the stars long dead, the ones that fused your carbon nuclei and the ones whose last thermonuclear death throes outshined the entire galaxy to send a single photon into your eye.

9. I want you to live forward but see backward, farther and deeper into the past, because in a relativistic universe you don't have any other choice. I want the stale billion-year-old starlight of a distant galaxy to be your reward.

10. I want to utterly disorient you and let you navigate back by the stars. I want you to lose yourself, and find it again, not just here, but everywhere, in everything.

11. I want to make you wonder what is out there. What dreams may come in waves of radiation across the breadth of an endless expanse. What we may know, given time, and what splendors might never, ever reach us.

12. I want to make it mean something to you. That you are *in* the cosmos. That you are *of* the cosmos. That you are born from stardust and to stardust you will return. That you are a way for the universe to be in awe of itself.